1 Van der Pol does not disclose a Coriolis flowmeter. He discloses only a segment of a flow tube. His disclosure and his claimed invention are directed to grooves and depressions formed in a flow tube having thick walls with pickoffs and drivers being positioned within the formed grooves. Van der Pol is concerned only with his thick walled flow tube and its grooves. He is not concerned with the flowmeter structure to which the ends of the flow tube would be connected, or how the flow tube would be connected or positioned in a flowmeter. Van der Pol does not disclose a flow tube formed of PFA material. He is not concerned with the fact that PFA material has a high flexibility, is limp, flaccid, and would have a rigidity substantially less than that of a flow tube formed of metal or glass as in Tanaka.

The structural differences which distinguish a PFA flow tube from one formed of metal or glass present numerous design problems which must be solved in order to use a PFA flow tube in a Coriolis flowmeter that is reliable and operates to perform a useful function in a commercial environment. None of these problems, nor the solution to these problems, is disclosed or addressed by van der Pol. The sole mention of PFA material in the van der Pol description is in claims 3 and 14 and in column 4, lines 30-34 which state, in essence, that the van der Pol flow tube can be made of anything known to the human race including metal, plastic, or PFA. There is, of course, no teaching in van der Pol as to how a flow tube made out of PFA could be fabricated or how the resultant PFA flow tube could be incorporated into a Coriolis flowmeter that operates to perform a useful function and generate output data that is reliable. This deficiency of van der Pol is understood since his invention is not directed to a Coriolis flowmeter. It is directed to a thick-walled flow tube having grooves formed in the flow tube wall to accept transducers. Van der Pol does not show how his flow tube could be incorporated into a flowmeter.

While van der Pol is presumed to be enabling for the purpose of the invention to which this patent is directed, it is not an enabling reference with respect to the details of a Coriolis flowmeter having a flow tube formed of PFA as set forth in the claims of the present invention.

2 Tanaka, by itself, does not anticipate claim 1 as filed whose lines 4-6 require that the flow tube means be formed of the material <u>that does not transfer ions from the flow tube means to the process material</u>. The glass flow tube of Tanaka does not meet this requirement since the glass is formed of sand and metal antioxidants <u>which</u>

can leach ions into the flowing material to contaminate it and render it useless for in semi-conductor fabrication processes. Tanaka does not assert that the glass used in his flow tube is free from impurities which leach ions into the contained material flow. Thus, Tanaka does not anticipate the requirement of claim 1 as filed. See the attached Rule 132 affidavit of Dr. Gary E. Pawlas for further information regarding ions and other impurities in the glass flow tube of Tanaka.

In spite of the applicant's belief that neither Tanaka nor van der Pol, taken alone or in combination, anticipates claim 1 as filed, claim 1 has been amended to recite:

> "said flow tube apparatus has high flexibility and also has a high stiffness substantially lower than a flow tube apparatus formed of metal or glass."

This recitation defines a flow tube formed of a flexible plastic substance including PFA. This recitation obviously avoids Tanaka whose glass flow tube cannot be said to have high flexibility as well as a stiffness substantially lower than a flow tube apparatus formed of metal or glass. Van der Pol adds nothing of anticipatory value to Tanaka with respect to claim 1 either as filed or as amended. The invention disclosed and claimed by van der Pol must be limited to a flow tube which van der Pol asserts may be formed of PFA and whose flow tube has thick walls containing grooves into which transducers may be inserted. This is all van der Pol discloses and his patent is therefore enabling only with respect to the invention disclosed by him. Van der Pol discloses nothing more than this; he does not disclose how his flow tube may be used as a PFA flow tube of a Coriolis flowmeter. Van der Pol most certainly does not disclose how his suggested PFA flow tube could used as a flow tube of a Coriolis flowmeter as characterized by amended claim 1.

Statements of these type made by van der Pol regarding a suggested use of a PFA flow tube are commonly referred to as "could be" "can be" assertions. "Could be" and "can be" statements are often non-enabling since, by themselves, they do not set forth enough information to enable one skilled in the art to practice the invention without undue experimentation or how to construct a structure to which the "could be" or "can be" statement refers.

Philosophically one can state that a car can be designed to get 1,000 miles to the gallon or that a rocket ship could be designed to travel through interplanetary

space at warp speeds. These "could be" and "can be" type statements are interesting when one is engaged in "philosophical meditations" and "musings" regarding what "can be", "could be" or "might be". However, the presence of these "musings" in a patent most often do not amount to a teaching of how the structure to which the "musing" pertains could be built or achieved. A "musing" that a car can be designed to get 1,000 miles to the gallon is not a teaching of how to construct such a car. A "musing" that a flow tube could be constructed of PFA is not a teaching of how the PFA flow tube could be embodied into a working Coriolis flowmeter that would operate and generate reliable information without undue experimentation by one skilled in the art to which the invention pertains.

The literature, including patents, is replete with "could be" and "can be" statements asserting that a structure or apparatus "could be" constructed of material other than that disclosed as the preferred embodiment. These statements often amount to an assertion that, in essence, a disclosed structure apparatus "could be" made out of any material known to the human race. It is common in Coriolis flowmeter patents to find "could be" and "can be" statements asserting that the flowmeter as disclosed and claimed "could be" made out a long list of materials that often include glass or plastic. Most often these statements are self-serving since they rarely contain supporting information as to how the suggested elements and materials could be used in the invention to which the patent is directed. Consequently, these statements often raise questions regarding the extent to which they are sufficiently enabling so as to permit one skilled in the art to which the patent pertains to build a device that implements the use of the suggested material as an alternative to the preferred material disclosed and claimed in the patent.

A solution to the problem of enablement with regard to these "could be" and "can be" statements is set forth below. It is submitted that the enablement problem may be resolved by determining whether the use of a substitute material can affect or alter the functionality of the structure modified by the proposed substitution. For example, a rolling pin is typically formed of wood. But a rolling pin could be formed of other material such as metal or plastic without altering the functionality of the rolling pin. A metal or plastic rolling pin may function equally as well as does a wood rolling pin. Similarly, a toilet seat is typically formed of wood and/or plastic. But, a toilet seat could easily be formed of metal without altering the functionality of the toilet seat.

Thus, a statement to the effect that a rolling pin or a toilet seat could be formed of such altered materials in all probability would be enabling since one skilled in the art of rolling pins or toilet seats could handily construct a rolling pin or a toilet seat from the suggested alternate materials without undue experimentation.

A different condition pertains when a suggested use of an alternate materials can affect the functionality of the device modified by the substituted material. The flow tube of a Coriolis flowmeter is an active part of the flowmeter and comprises all or part of the vibrating structure of the flowmeter. The suggested use of alternate material for a flow tube is more complex than the use of a substitute material in a toilet seat or a rolling pin. All aspects, characteristics, and features of the material comprising a flow tube must be studied, analyzed, considered, evaluated, and tested to see what problems may arise in the use of the substitute material and to see whether the substituted material could be used to construct a Coriolis flowmeter that would reliably operate to produce valid output data in a commercial environment to which Coriolis flowmeters are subjected. The issues that must be analyzed and evaluated include manufacturability, thermal characteristics, mechanical characteristics such as density, Young's modulus of elasticity, flexibility, susceptibility to cracking, expected life of the substituted material, etc. In some cases, the studies and evaluations may indicate that the suggested substitute material is not suitable for use in a Coriolis flowmeter. In other instances, the studies and evaluations may indicate that the suggested modification is feasible or that further studies may be required to prove or disprove their suitability.

In most cases, the required studies and evaluations are far more complex than those involved in substituting one material for another in a toilet seat. The complexities required for these studies would not be routine or trivial and the implementation of the suggested modifications in a Coriolis flowmeter would not be obvious to one skilled in the art without undue experimentation. In many instances, these studies would require considerable experimentation to evaluate feasibility, alternative procedures and backtracking when a first alternative fails in order to successfully determine with certainty the suitability of the suggested modification for commercial use in a Coriolis flowmeter.

The attached 132 Affidavit by Dr. Gary Pawlas states that he has read the Tanaka and van der Pol patents, including the statement in the van der Pol that his

flow tube could be made out of PFA, and that he, Dr. Pawlas, could not construct a working flowmeter containing a PFA flow tube based upon the information set forth in van der Pol. Dr. Pawlas asserts that the information in van der Pol is insufficient for him to construct an operable Coriolis flowmeter formed of PFA without undue experimentation including considerable time and expense. Dr. Pawlas was head of the development group that designed and developed the Coriolis flowmeter of the present invention. His affidavit includes a detailed recitation and enumeration of the trials and tribulations involved and the time and expense required to successfully reduce a Coriolis flowmeter embodying the present invention.

In summary, it must be concluded that the glass flowmeter of Tanaka is of no anticipatory value to the invention as claimed since glass leaches ions into the process material flowing in the flow tube. It further must be concluded that van der Pol's suggested use of PFA material for a flow tube is not enabling with respect to the present invention for the reasons above discussed. The applicants must therefore respectfully traverse the Examiner's assertion that claim 1 as filed is obvious over the combination of Tanaka and van der Pol. Also, Claim 1 has been amended as above discussed to make it further distinguishable from van der Pol and/or Tanaka by inserting the requirement that the flow tube is flexible and has a lower rigidity than has a flow tube made of metal or glass.

Re: rejection of claims 1, 3, 4, 39 and 40

The following comments pertain to the rejections set forth beginning on the bottom of page 4 of the Office Action pertaining to claims 1, 3, 4, 39 and 40. The applicants' comments regarding claim 1 have already been set forth. The Examiner's statement on the bottom of page 4 of the Office Action is inaccurate since, in the present invention, the ions are prevented from passing into the material flow by the use of PFA which, by itself, does not leach ions into the material flow. The wall thickness of the PFA has nothing to do with ion leaching. The use of non-PFA material such as glass would permit the ions to leach from the glass into the material flow regardless of the thickness of the glass flow tube wall.

The Examiner stated that it would have been obvious to one skilled in the art to use the PFA flow tube segment of van der Pol for the Tanaka flow tube to create a thick walled body. The Applicants' flow tube does not have a thick wall; the

thickness of the wall has nothing to do with the goal of preventing ion leaching from the flow tube wall into the material flow. Thus, the Examiner's statements regarding dependent claims 3, 4, 39 and 40 are therefor respectfully traversed.

Re: the rejection of dependent claims 12-14 and 41

There is no information in Tanaka regarding the relative mass of the flow tube compared to that of the base. Nor is there any statements in Tanaka to the effect that the mass of the base is a 1,000 times or a 100 times that of the flow tube. A mere assertion by the Examiner that this would be obvious is of no probative value. Something is not obvious merely because the Examiner proclaims this to be the case. A claim can be concluded to be obvious over a reference only when the assertion of obviousness is accompanied by supporting evidence proving a prima facie case of obviousness. If the Examiner persists on this issue, it is respectfully requested that evidence be presented disclosing a Coriolis flowmeter having a base that is a 1,000 or 100 times the mass of the flow tube for the purpose of stabilizing the vibration of the flow tube. Until such evidence is presented, it must be respectfully submitted that this rejection is legally unsupportable. Further, the dependent claims should be allowable as being dependent on an allowable independent claim (1, 26).

Re: dependent claim 21

The obviousness rejection of claim 21 is similarly improper since it is merely an assertion of obviousness without accompanying evidence proving a prima facie case of obviousness. Also, claim 21 should be allowable as being dependent on allowable claim 1.

Re: independent claim 26

Independent claim 26 has been rewritten to better distinguish it from the cited art and now recites that the flow tube is formed of PFA which does not transfer ions. Independent claim 26, as now amended, also recites that the single flow tube has high flexibility and a stiffness substantially lower than that of a glass or metal flow tube. As amended, it also now recites a massive base affixed to the ends of the flow tube to absorb undesired vibratory forces. Claim 26 has also been amended for linguistic

reasons as shown in the attached redline document. The obviousness rejection of claim 26 is respectfully traversed for the same reason as discussed for claim 21.

Re: dependent claim 42

Claim 42 depends on an allowable claim 26 and should therefore be allowable. The rejection of claim 42 is respectfully traversed for the same reasons discussed for claim 21.

Re: The rejection of dependent claims 5 and 28

These dependent claims should be allowable as being dependent on an allowable independent claim (1, 26). In addition, the obviousness rejection applied to claims 5 and 28 is respectfully traversed for the same reasons as set forth with respect to claim 21.

Re: The rejection of dependent claims 6 and 29

Dependent claims 6 and 29 should be allowable as being dependent on an allowable independent claim (1, 26).

The obviousness rejection asserted against these claims is traversed for the same reasons as set forth with regard to claim 21. Further, Kalotay does not disclose an optical detector pickoff means. He discloses a pickoff means comprising an optical fiber which generates output signals by means of the variable attenuation of the light signal through the optical fiber in response to the bending (microbending) of the fiber. Kalotay's optical fibers are not optical detectors; they are impedance modulators with the impedance of the fiber to light being controllably determined by the vibrations of the flow tube.

Re: The rejection of dependent claims 7-9, 18, 25, 30, 31, and 33

These dependent claims are allowable as being dependent upon an allowable independent claim (1, 26). The obviousness rejection asserted against these claims is respectfully traversed for the same reasons discussed above for claim 21.

Re: The rejection of dependent claims 16, 17, 34, 35, 37, 38, and 43

These claims should be allowable as being dependent upon an allowable dependent claim (1, 26). The obviousness rejection applied to these claims is respectfully traversed for the same reasons above set forth for the preceding dependent claims.

Re: The rejection of dependent claim 22

This claim is dependent upon an allowable independent claim 1 and should therefore be allowable. The obviousness rejection of claim 22 is respectfully traversed for the same reasons discussed in the preceding paragraph. Also, dependent claim 22 should be allowable as being dependent upon allowable claim 1.

Re: The rejection of dependent claim 27

This claim is dependent upon an allowable independent claim 1 and should therefore be allowable. The obviousness rejection of this claim is respectfully traversed for the same reason above discussed for the prior dependent claims. In addition, dependent claim 27 should be deemed to be allowable as being dependent upon allowable claim 1.

Re: claims 1-44

This amendment revised claim 1 as above discussed. Claim 2 has been amended to state that the flow tube apparatus defines a substantially straight single flow tube. This is not shown in the cited art. Claim 3 is unchanged and recites, in essence, that the entirety of the wetted path of the Coriolis flowmeter comprises PFA. This is not shown in the cited art. Claim 4, as amended, states that the flow tube apparatus defines more than one flow tube. The remainder of the claims have been amended for linguistic reasons or left unamended as shown in the attached redlined document.

The attached redlined document shows the changes made to the application including the description and the claims.

Respectfully submitted,
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REDLINE VERSION

Please replace the Aspects beginning on page 7, line 14 through page 14, line 24 with the following:

ASPECTS

An aspect of the invention is a Coriolis flowmeter for measuring a process material flow having an ultra high level of purity, said Coriolis flowmeter comprising:

a base;

flow tube **[means]** apparatus adapted to receive said process material flow, said flow tube **[means]** apparatus is formed of a material that does not transfer ions from said flow tube **[means]** apparatus to said process material;

[ends] end portions of said flow tube **[means]** apparatus are coupled to said base to create substantially stationary nodes at said **[ends;]** end portions;

said flow tube apparatus has high flexibility and also has a stiffness substantially lower than flow tube apparatus formed of metal or glass;

a driver coupled to said flow tube **[means]** apparatus for vibrating said flow tube **[means]** apparatus containing said process material flow;

pickoff means coupled signalwise to said flow tube **[means]** apparatus for generating signals representing induced Coriolis deflections of **[the portions of]** said vibrating process material filled flow tube **[means proximate said pickoff means]** apparatus; and

meter electronics that receives said signals from said pickoff means and generates output information pertaining to said process material flow.

Preferably **[said driver vibrates said flow tube means at a resonant frequency of said]** apparatus defines a substantially straight single flow tube **[means containing said process material]**.

Preferably the entirety of the wetted flow path of said Coriolis flowmeter comprises a PFA substance.

Preferably said flow tube **[means is formed of a PFA substance to maintain said process material free from contamination due to ion transfer from said]** apparatus defines more than one flow tube **[means to said process material]**.

Preferably said pickoff means is an electro-magnetic device having a magnet connected to said flow tube **[means]** **apparatus** and **further having** a coil.

Preferably said pickoff means **[alternatively]** comprises a light source and an optical detector;

said **vibrating** flow tube **[means]** **apparatus** is positioned between said light source and said optical detector to alter the characteristics of the light received by said optical detector from said light source**[,]**;

said optical detector is responsive to said alteration to generate said signals representing said Coriolis deflections.

Preferably said base has a lower surface and an inner pair of upwardly extending side walls **[and also has]** **as well as** an outer pair of upwardly ending walls;

openings in each of said upwardly extending walls **are** coaxially aligned to receive said flow tube **[means]** **apparatus**.

Preferably said base **[alternatively is]is substantially** u-shaped and has a lower surface and a pair of upwardly extending **[side walls]** **walls proximate sides of said base**;

openings in each of said upwardly extending walls **are** coaxially aligned to receive said flow tube **[means]** **apparatus**.

Preferably ends of said flow tube **[means]** **apparatus** extend beyond said **[side]** walls.

Preferably said base **[alternatively]** is a solid rectangular element **<u>defining a parallelepiped</u>**;

said flow tube **[means is mounted]** **<u>apparatus is connected to posts affixed between said walls</u>** to a top surface of said base.

Preferably an inlet of said flow tube **[means]** <u>apparatus</u> receives said process material flow from a supply tube;

an outlet of said flow tube **[means]** <u>apparatus</u> is coupled to an inlet of a return tube;

said return tube **[which]** is coupled to said base and is positioned parallel to said flow tube **[means]** <u>apparatus</u> and extends through walls of said base, and

[an exit] <u>said return</u> tube is <u>adapted to be</u> connected to an **[outlet end of said return]** <u>exit</u> tube to extend said process material flow towards a user application.

Preferably said flow tube **[means]** <u>apparatus</u> comprises a single flow tube and that said base has a mass substantially greater than the mass of said flow tube with process material.

[Preferably a return tube is coupled to said base and positioned parallel to said single flow tube;

an inlet of said flow tube is adapted to receive said process material flow;

an outlet of said single flow tube is coupled to an inlet of said return tube to extend said process material flow to an inlet of said return tube; and

an exit tube is connected to an outlet of said return tube to extend said material flow towards a user application.]

Preferably the mass of said base is at least 1000 times the mass of said single flow tube with process material.

Preferably the mass of said base is at least 100 times the mass of said single flow tube with process material.

Preferably said driver is affixed to the top of said single flow tube when in use.

Preferably a dynamic balancer means coupled to said base proximate said nodes to maintain said nodes at a reduced level of vibration.

Preferably said dynamic balancer means is an active dynamic balancer controlled by the exchange of signals with said meter electronics.

Preferably said base is **substantially** u-shaped and has a lower surface and a pair of upwardly extending side walls containing coaxially aligned openings for receiving said **single** flow tube.

Preferably said single flow tube extends through coaxial **[holes]** **openings** in said walls **[with ends of said single flow tube extending beyond said side walls.]**

[Preferably an outlet of said single flow tube is coupled to an inlet of a return tube positioned in said base parallel to said single flow tube and extending through the walls of said base; and

an exit tube is connected to an outlet end of said return tube to extend said material flow towards a user application.]

[Preferably said base is a parallelepiped element;
said flow tube means is mounted posts affixed to a top surface of said base].

Preferably said flow tube **[means alternatively]** **apparatus** comprises a first and a second flow tube coupled to said base and positioned parallel to each other, said first and second flow tubes are adapted to be vibrated in phase opposition by said driver.

Preferably said driver is affixed to both said first flow tube and said second flow tube and is adapted to vibrate said first and second flow tubes in phase opposition;

said pickoffs being affixed to both said first and second flow tubes to detect the Coriolis deflections of said first and second flow tubes.

Preferably said first and second flow tubes are connected in series with respect to said material flow.

Preferably said first and second flow tubes are **[alternatively]** connected in parallel with respect to said material flow.

Preferably a return tube **[is]** coupled to said base **and** oriented parallel to said first and second flow tubes;

said return tube receives said process material flow from said first and second flow tubes and extends said material flow towards a user application.

Preferably **said base is** **[the Coriolis flowmeter comprises:a]** u-shaped **[base having]** **and has** upwardly extending walls;

said first and second flow tubes extend through said walls of said base and have inlet and outlet ends projecting beyond the outer surfaces of said walls.

Another aspect comprises a Coriolis flowmeter for measuring a flow of process material having an ultra high level of purity;

said Coriolis flowmeter comprising:

a single flow tube formed of a material**, such as PFA,** that does not transfer ions from said single flow tube to said process material;

said single flow tube has high flexibility and further has a stiffness substantially lower than a metal or glass flow tube;

the entirety of the wetted path of said Coriolis flowmeter comprises said PFA material;

a driver affixed to said single flow tube for vibrating said single flow tube containing said process material flow;

a massive base affixed to ends of said single flow tube to **[reduce undesired vibrations by creating]** **absorb undesired vibratory forces generated by said vibrating flow tube;**

said base defines stationary nodes at **[said]** ends **of said flow tube**;

an inlet connector connected to said massive base and adapted to receive a flow of said process material from a supply tube;

an inlet **end** of said single flow tube is affixed to said inlet connector**[,];**

said input connector sealably connects said inlet **end** of said single flow tube to an outlet **end** of said supply tube to effect the extension of said process material flow in said supply tube to said single flow tube;

[a first set screw in] said inlet connector maintains said inlet **[connector]** **end of said flow tube** fixed with respect to said massive base;

[a driver affixed to said single flow tube for vibrating said single flow tube containing said process material flow;]

an outlet **end** of said single flow tube **[coupled]** **affixed** to a **second** connector for extending said process material flow via an exit tube towards a user destination**;**

a pair of pickoffs coupled to said single flow tube on opposite sides of said driver for generating signals representing Coriolis induced deflections of **[the portions of]** said vibrating material filled single flow tube **[associated with each pickoff]**; **[and]**

meter electronics; **and**

conductors extending **signals** from said pickoffs **[to said meter electronics for extending said pickoff signals]** to said meter electronics;

said meter electronics receives said pickoff output signals and generates output information pertaining to said process material flow.

Preferably**[the Coriolis flowmeter further comprising;]** a return tube connected to said massive base parallel to said single flow tube;

end portions **[of ends]** of said single flow tube and said return tube are glued to said massive base to maintain said single flow tube and said return tube immovable with respect to said massive base;

an inlet of said return tube;

an intermediate tube connecting said outlet **end** of said single flow tube and said inlet **end** of said return tube **via said second connector** to extend said process material flow from **said outlet end of** said single flow tube to said return tube;

an outlet connector connected to said massive base for receiving said flow of said process material from said **outlet end of said** return tube;

[an outlet of said return tube is affixed to said outlet connector,] said outlet connector sealably connects said outlet **end** of said return tube to an inlet **end** of an exit tube to effect the extension of said process material flow in said return tube to said exit tube ;

[a second set screw in said outlet connector maintains said outlet connector fixed with respect to said base;]said exit tube is adapted to extend said process material flow to a user destination**[;].**

Preferably said pickoffs are electro-magnetic devices each **[have]** **having** a magnet and a coil.

Preferably said pickoffs each **[alternatively]** comprises a light source and an optical detector with the magnitude of the Coriolis deflection of said single flow tube defining the magnitude of the output current of said optical detector.

[Preferably said massive base is u-shaped and has a lower surface and a pair of upwardly extending side walls containing coaxial openings through which said single flow tube and said return tube extend.]

Preferably said massive base has a pair of upwardly extending parallel side walls having **coaxial** openings through which said single flow tube and said return tube extend.

Preferably said massive base is substantially u-shaped.

Preferably said massive base is a <u>**solid**</u> rectangular element defining a parallelepiped;

said single flow tube **[and said return tube are]** <u>**is mounted to upwardly extending**</u> posts affixed to a **[top]** surface of said massive base.

Preferably ends of said single flow tube and said return tube extend beyond the outer surface of each leg.

Preferably said **[flow tube means comprises a single flow tube mounted to said massive base to define a dynamically unbalanced structure when vibrated by said driver.]**<u>**single flow tube is substantially straight.**</u>

Preferably <u>**Coriolis flowmeter comprises**</u> a second flow tube **[is]** coupled to said massive base to define a dynamically balanced structure when vibrated by said driver while containing said process material.

Preferably said driver is positioned when in use on a top surface of said single flow tube.

Preferably**[the Coriolis flowmeter further comprising:]** a dynamic balancer means coupled to said massive base proximate said nodes to reduce the vibration of said nodes.

Preferably said dynamic balancer means is an active dynamic balancer controlled by the exchange of signals with said meter electronics.

Preferably <u>**said first and second flow tubes have an irregular shape.**</u> **[the entirety of the wetted flow path of said Coriolis flowmeter comprises a PFA substance.]**

[Preferably said single flow tube is formed of a PFA substance to maintain said process material flow free from contamination due to ion transfer from said single flow tube to said process material.]

Preferably the mass of said massive base is at least [1000] __100__ times the mass of said [single] flow tube __**with material flow**__.

Preferably the mass of [the] __**said massive**__ base is at least [100] __**1000**__ times the mass of [the] __**said**__ single flow tube __**with material flow**__.

Preferably said driver vibrates said flow tube at a resonant frequency of said material filled flow tube.

Preferably said driver vibrates said flow tube at a non resonant frequency of said material filled flow tube.

Preferably said Coriolis flowmeter is adapted to extend a flow of corrosive material including nitric acid.

__Please replace the paragraph beginning on page 15, line 22 with the following:__

FIG. 1 is a perspective view of a first possible exemplary embodiment of the invention and discloses a flowmeter 100 having a flow tube 102 inserted through legs 117, 118 of base 101. __**Flowmeter 200 has a base 101, sidewalls 119 and 120, a front surface 116 and top wall surfaces 117 and 118.**__ Pickoffs LP0 and RP0 and driver D are coupled to flow tube 102. Flowmeter 100 receives a process material flow from supply tube 104 and extends the flow through connector 108 to flow tube 102. Flow tube 102 is vibrated at its resonant frequency with material flow by driver D. The resulting Coriolis deflections are detected by pickoffs LP0 and RP0 which apply signals over conductors 112 and 114 to meter electronics 121. Meter electronics 121 receives the pickoff signals, determines the phase difference between them, determines the frequency of oscillation and applies output information pertaining to the material flow over output path 122 to a utilization circuit not shown. The material flow passes from flow tube 102 and through tube 106 which redirects the material flow through return tube 103 through connector 107 to exit tube 105 which delivers the material flow to a user application. This user application may be a semiconductor processing facility. The

process material may be a semiconductor slurry which is applied to the surface of a semiconductor wafer to form a flat surface. The PFA material used in the flow tubes shown on FIG. 1 ensures that the process material is free of impurities such as ions which could be transferred from the walls of metals or glass flow tubes. Locking holes 130 receive set screws 411 to fixably connect element 111 to **[base101 as shown on Fig. 4.]** **base 101 as shown on FIG. 4.**

Please replace the paragraph beginning on page ~~15~~ 16, line 21 with the following:

Connectors 107, 108, 109 and 110 connect tubes 104, 105 and **intermediate tube** 106 to the ends of flow tube 102 and return tube 103. These connectors are shown in detail in FIG. 4. The connectors have a fixed portion 111 that includes threads 124. The movable portion of connectors 107 through 110 are threaded onto male threads 124 to connect their respective tubes to the fixed body of the connector of which the fixed portion 111 is a part. These connectors function in a manner similar to the well known copper tubing flared connectors to connect tubes 104, 105 and 106 to ends of flow tube 102 and return tube 103. Details regarding the connectors are further shown in FIG. 4. RTD is a temperature sensor that detects the temperature of return tube 103 and transmits signals representing the detected temperature over path 125 to meter electronics.

Please replace the paragraph beginning on page 17, line 2 with the following:

In FIG. 2 is a top view of flowmeter 100 of FIG. 1. Pickoffs LP0 and RP0 and driver D each include a coil C. Each of these elements further includes a magnet which is affixed to the bottom portion of flow tube 102 as shown in FIG. 3. Each of these elements further includes a base, such as 143 for driver D, as well as a thin strip of material, such as 133 for driver D. The thin strip of material may comprise a printed wiring board to which coil C and its winding terminals are affixed. Pickoffs LP0 and RP0 also have a corresponding base element and a thin strip fixed to the top of the base element. This arrangement facilitates the mounting of a driver or a pickoff to be accomplished by the steps of gluing a magnet M to the underside of PFA flow tube, gluing the coil C to a printed wiring

board 133 (for driver D), positioning the opening in coil C around the magnet M, moving the coil C upwardly so that the magnet M fully enters the opening in coil C, then positioning base element 143 underneath the printed wiring board 133 and gluing or bolting these elements together so that the bottom of base 143 is affixed by glue to the surface of the massive base **[116.]<u>101.</u>**

<u>Please replace the paragraph beginning on page 24, line 24 with the following:</u>

Figure 16 discloses an alternative embodiment 1600 that is similar to the embodiment of FIG. 14. **<u>It has a base 1601, front surface 1616, side walls 1644 and 1641 and front wall surfaces 1644.</u>** The differences are that upwardly extending inner mounting posts 1617 and 1618 replace walls 1417 and 1418 of FIG. 14. Also upwardly extending outer mounting posts 1643 and 1645 replace walls 1443 and 1445 of FIG. 14. Outer posts 1643 and 1645 prevent flow tube 1602 from pivoting about post 1617 and 1618 as an axis. Connectors 1608 and 1609 are optional and if desired flow tube 1602 may extend outwardly through posts 1643 and 1645 and replace inlet tube 1604 and outlet tube 1402. The extended flow tube may be connected downstream and upstream by a user to the user's equipment. Posts 1443 and 1445 serve as a mounting for connector 1608 and 1609 when provided.

What is Claimed:

1. A Coriolis flowmeter for measuring a process material flow having an ultra high level of purity, said Coriolis flowmeter comprising:

a base;

flow tube **[means]** **apparatus** adapted to receive said process material flow, said flow tube **[means]** **apparatus** is formed of a material that does not transfer ions from said flow tube **[means]** **apparatus** to said process material;

end portions of said flow tube **[means]** **apparatus** are coupled to said base to create substantially stationary nodes at said end portions;

said flow tube apparatus has high flexibility and also has a stiffness substantially lower than flow tube apparatus formed of metal or glass;

a driver coupled to said flow tube **[means]** **apparatus** for vibrating said flow tube **[means]** **apparatus** containing said process material flow;

pickoff means coupled signalwise to said flow tube **[means]** **apparatus** for generating signals representing induced Coriolis deflections of said vibrating process material filled flow tube **[means]** **apparatus**; and

meter electronics that receives said signals from said pickoff means and generates output information pertaining to said process material flow.

2. The Coriolis flowmeter of claim 1 characterized in that said **[driver vibrates said flow tube means containing said process material]** **flow tube apparatus defines a substantially straight single flow tube**.

3. The Coriolis flowmeter of claim1 characterized in that the entirety of the wetted flow path of said Coriolis flowmeter comprises a PFA substance.

4. The Coriolis flowmeter of claim 1 characterized in that said flow tube **[means is formed of a PFA substance to maintain said process material free from contamination due to ion transfer from said]** **apparatus defines more than one** flow tube **[means to said process material]**.

5. The Coriolis flowmeter of claim 1 characterized in that said pickoff

means is an electro-magnetic device having a magnet connected to said flow tube **[means]** <u>**apparatus**</u> and <u>**further having**</u> a coil.

6. The Coriolis flowmeter of claim 1 characterized in that said pickoff means comprises a light source and an optical detector;

said vibrating flow tube **[means]** <u>**apparatus**</u> is positioned between said light source and said optical detector to alter the characteristics of the light received by said optical detector from said light source,

said optical detector is responsive to said alteration to generate said signals representing said Coriolis deflections.

7. The Coriolis flowmeter of claim 1 characterized in that said base has a lower surface and an inner pair of upwardly extending side walls **[and also has]** <u>**as well as**</u> an outer pair of upwardly ending walls;

openings in each of said upwardly extending walls <u>**are**</u> coaxially aligned to receive said flow tube **[means]** <u>**apparatus**</u>.

8. The Coriolis flowmeter of claim 1 characterized in that said base is <u>**substantially**</u> u-shaped and has a lower surface and a pair of upwardly extending **[side walls]** <u>**walls proximate sides of said base**</u>;

openings in each of said upwardly extending walls <u>**are**</u> coaxially aligned to receive said flow tube **[means]** <u>**apparatus**</u>.

9. The Coriolis flowmeter of claim **[1]** <u>**8**</u> characterized in that ends of said flow tube **[means]** <u>**apparatus**</u> extend beyond said **[side]** walls.

10. The Coriolis flowmeter of claim 1 characterized in that said base is a solid rectangular element defining a parallelepiped;

said flow tube **[means]** <u>**apparatus**</u> is connected to posts affixed <u>**between said walls**</u> to a top surface of said base.

11. The Coriolis flowmeter of claim 1 characterized in that:

an inlet of said flow tube **[means]** **apparatus** receives said process material flow from a supply tube;

an outlet of said flow tube **[means]** **apparatus** is coupled to an inlet of a return tube;

said return tube is coupled to said base and is positioned parallel to said flow tube **[means]** **apparatus** and extends through walls of said base, and

[an exit tube is connected to an outlet end of] **said return tube is adapted to be connected to an exit tube** to extend said process material flow towards a user application.

12. The Coriolis flowmeter of claim 1 characterized in that said flow tube **[means]** **apparatus** comprises a single flow tube and that said base has a mass substantially greater than the mass of said flow tube with process material.

13. The Coriolis flowmeter of claim 12 characterized in that the mass of said base is at least 1000 times the mass of said single flow tube with process material.

14. The Coriolis flowmeter of claim 12 characterized in that the mass of said base is at least 100 times the mass of said single flow tube with process material.

15. The Coriolis flowmeter of claim 12 in which said driver is affixed to the top of said single flow tube when in use.

16. The Coriolis flowmeter of claim 12 further comprising:

a dynamic balancer means coupled to said base proximate said nodes to maintain said nodes at a reduced level of vibration.

17. The Coriolis flowmeter of claim 16 characterized in that said dynamic balancer means is an active dynamic balancer controlled by the exchange of signals with said meter electronics.

18. The Coriolis flowmeter of claim **[1]** **12** characterized in that said base is **substantially** u-shaped and has a lower surface and a pair of upwardly extending side walls containing coaxially aligned openings for receiving said single flow tube.

19. The Coriolis flowmeter of claim **[12]** **18** characterized in that said single flow tube extends through coaxial **[holes]** **openings** in said walls **[with ends of said single flow tube extending beyond said side walls]**.

20. The Coriolis flowmeter of claim 1 characterized in that said flow tube apparatus comprises a first and a second flow tube coupled to said base and positioned parallel to each other, said first and second flow tubes are adapted to be vibrated in phase opposition by said driver.

______21. The Coriolis flowmeter of claim **[12.0]** **20** **[further comprising]** **characterized in that**:

said driver is affixed to both said first flow tube and said second flow tube and is adapted to vibrate said first and second flow tubes in phase opposition;

said pickoffs being affixed to both said first and second flow tubes to detect the Coriolis deflections of said first and second flow tubes.

22. The Coriolis flowmeter of claim 20 characterized in that said first and second flow tubes are connected in series with respect to said material flow.

23. The Coriolis flowmeter of claim 20 characterized in that said first and second flow tubes are connected in parallel with respect to said material flow.

24. The Coriolis flowmeter of claim 20 further comprising:
a return tube coupled to said base **and** oriented parallel to said first and second flow tubes;

said return tube receives said process material flow from said first and second flow tubes and extends said material flow towards a user application.

25. The Coriolis flowmeter of claim 20 characterized in that:

said base is u-shaped and has upwardly extending walls;

said first and second flow tubes extend through said walls of said base and have inlet and outlet ends projecting beyond the outer surfaces of said walls.

26. A Coriolis flowmeter for measuring a flow of process material having an ultra high level of purity;

said Coriolis flowmeter comprising:

a single flow tube formed of a material**, such as PFA,** that does not transfer ions from said single flow tube to said process material;

said single flow tube has high flexibility and further has a stiffness substantially lower than a metal or glass flow tube;

the entirety of the wetted path of said Coriolis flowmeter comprises said PFA material;

a driver affixed to said single flow tube for vibrating said single flow tube containing said process material flow;

a massive base affixed to ends of said single flow tube to **[reduce undesired vibrations by creating] absorb undesired vibratory forces generated by said vibrating flow tube;**

said base defines stationary nodes at **[said]** ends **of said flow tube**;

an inlet connector connected to said massive base and adapted to receive a flow of said process material from a supply tube;

an inlet **end** of said single flow tube is affixed to said inlet connector**[,];**

said input connector sealably connects said inlet **end** of said single flow tube to an outlet **end** of said supply tube to effect the extension of said process material flow in said supply tube to said single flow tube;

[a first set screw in] said inlet connector maintains said inlet **[connector] end of said flow tube** fixed with respect to said massive base;

[a driver affixed to said single flow tube for vibrating said single flow tube containing said process material flow;]

an outlet **end** of said single flow tube affixed to a second connector for extending said process material flow via an exit tube towards a user destination;

a pair of pickoffs coupled to said single flow tube on opposite sides of said driver for generating signals representing Coriolis induced deflections of said vibrating material filled single flow tube;**[and]**

meter electronics; **and**

conductors extending **signals** from said pickoffs **[to said meter electronics for extending said pickoff signals]** to said meter electronics;

said meter electronics receives said pickoff output signals and generates output information pertaining to said process material flow.

27. The Coriolis flowmeter of claim 26 further comprising;

a return tube connected to said massive base parallel to said single flow tube;

end portions of said single flow tube and said return tube are glued to said massive base to maintain said single flow tube and said return tube immovable with respect to said massive base;

an inlet of said return tube;

an intermediate tube connecting said outlet **end** of said single flow tube and said inlet **end** of said return tube via said second connector to extend said process material flow from **said** outlet **end** of said single flow tube to said return tube;

an outlet connector connected to said massive base for receiving said flow of said process material from **[an]** **said** outlet **end** of said return tube;

[said outlet of said return tube is affixed to said outlet connector,]

said outlet connector sealably connects said outlet **end** of said return tube to an inlet **end** of an exit tube to effect the extension of said process material flow in said return tube to said exit tube ;

[said outlet connector maintains said outlet connector fixed with respect to said base;]

said exit tube is adapted to extend said process material flow to a user destination.

28. The Coriolis flowmeter of claim 26 characterized in that said pickoffs are electro-magnetic devices each having a magnet and a coil.

29. The Coriolis flowmeter of claim 26 characterized in that said pickoffs each comprises a light source and an optical detector with the magnitude of the Coriolis deflection of said single flow tube defining the magnitude of the output current of said optical detector.

30. The Coriolis flowmeter of claim **[26]** <u>27</u> characterized in that said massive base has a pair of upwardly extending parallel side walls having coaxial openings through which said single flow tube and said return tube extend.

31. The Coriolis flowmeter of claim 30 characterized in that said massive base is <u>**substantially**</u> u-shaped.

32. The Coriolis flowmeter of claim 26 characterized in that said massive base is a solid rectangular element defining a parallelepiped;

said single flow tube is mounted to upwardly extending posts affixed to a surface of said massive base.

33. The Coriolis flowmeter of claim 30 in which ends of said single flow tube and said return tube extend beyond the outer surface of each leg.

34. The Coriolis flowmeter of claim 26 characterized in that said **[flow tube means comprises a single flow tube mounted to said massive base to define a dynamically unbalanced structure when vibrated by said driver]** <u>single flow tube is substantially straight</u>.

35. The Coriolis flowmeter of claim 26 <u>**further**</u> comprising a second flow tube coupled to said massive base to define a dynamically balanced structure when vibrated by said driver while containing said process material.

36. The Coriolis flowmeter of claim 26 characterized in that said driver is positioned when in use on a top surface of said single flow tube.

37. The Coriolis flowmeter of claim 26 further comprising:

a dynamic balancer means coupled to said massive base proximate said nodes to reduce the vibration of said nodes.

38. The Coriolis flowmeter of claim 37 characterized in that said dynamic balancer means is an active dynamic balancer controlled by the exchange of signals with said meter electronics.

39. The Coriolis flowmeter of claim **[26]** 35 characterized in that **[the entirety of the wetted flow path of said Coriolis flowmeter comprises a PFA substance] said first and second flow tubes have an irregular shape**.

40. The Coriolis flowmeter of claim 26 characterized in that **[said single flow tube is formed of a PFA substance to maintain said process material flow free from contamination due to ion transfer from said single flow tube to said process material.] the mass of said massive base is at least 100 times the mass of said flow tube with material flow.**

41. The Coriolis flowmeter of claim 26 characterized in that the mass of said massive base is at least 1000 times the mass of said single flow tube **with material flow**.

42. The Coriolis flowmeter of claim 26 characterized in that said driver vibrates said flow tube at a resonant frequency of said material filled flow tube.

43. The Coriolis flowmeter of claim 26 characterized in that said driver vibrates said flow tube at a non resonant frequency of said material filled flow tube.

44. The Coriolis flowmeter of claim 40 characterized in that said Coriolis flowmeter is adapted to extend a flow of corrosive material including nitric acid.